MARINE FAUNA IDENTIFICATION VIA IMAGE ANALYSIS FROM OBSEA

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Abstract. The OBSEA laboratory has integrated an IP-Video camera that works 24 hours per day recording images of local fauna. These images have been analyzed in order to identify the different marine organisms in the vicinities.

Introduction

OBSEA is an underwater observatory connected to an earth station via a cable that provides electrical energy and a fiber optic link. One of the instruments attached to the OBSEA is a digital video camera that takes real-time images of the seafloor, which allows the observation and recognition of several different marine organisms near the area where OBSEA is located, Figure 1.
The study evaluates the fluctuations in counted individuals for several fish species by video image analysis, Figure 2. Long-term data sets were acquired as an example of the high scientific value and practical application of OBSEA. With derived counts the local biodiversity in an artificial reef from a marine protected area has been estimated.

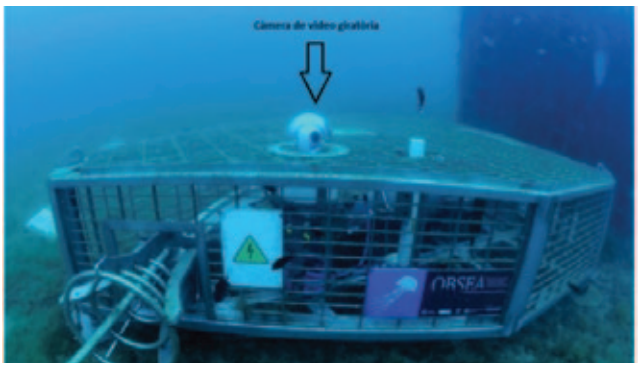

Figure 1. Expandable Seafloor Observatory in front of Vilanova i la Geltrú with the side detail of the artificial barrier.

Figure 2. Artificial reef in Colls Miralpeix Marine Reserve.

Acquisition

Digital images were acquired only during daylight hours, one each 60 min at different angles in order to cover a complete 360º rotation. This spatial and temporal transect was composed by 8 positions (images): 3 focusing on the artificial reef; 4 focusing on sandy bottom where the algae Caulerpa racemosa dominates; and finally 1 focusing on the water mass. Two images with reef and two images without reef were taken at the beginning of each hour of the day during the first two weeks of every month, on alternate days from July to November 2009. Both pairs replicas were used in order to: 1) to study the effect of reef presence/absence, on recognized fishes, biodiversity and the relative abundance of their local populations; and 2) to characterize the temporal patterns of distribution at daily and seasonal scales (i.e. intraday and seasonal replicas). Variables studied were: 1) identified fish to species 2) total fish number per species; 3) the Shannon biodiversity index, see Figure 3 and Figure 4. In frames where fish density were too large (i.e. in schools and banks) we considered the total number as equal to 50, but in few clear cases the number was 100.

Results

Our results indicated that the local specific composition was similar to other Western Mediterranean areas. There were 38% of visualized but not identified fish species, since too distant individuals were not distinguishable. Fish species, such as Common two-banded Seabream (Diplodus vulgaris), Damselfish (Chromis chromis), Black Seabream (Spondylosoma cantharus), Withe Seabream (Diplodus sargus), Annular Seabream (Diplodus annularis) and Common Dentex (Dentex dentex), showed different levels of diel and seasonal variation. Daily variability is important for few species as top-down predators (D. Dentex) which appeared mostly in crepuscular hours. Seasonal variability is very important and determines the principal changes suffered in reefs populations during the year cycle. The reef exerted a strong influence on species composition. The effect of increasing structural complexity on biodiversity was already detected in several previous studies. Fish schools were often located in one side of the reef or in the other. That behavior optimizes efforts in front of strong current episodes. Some author argued fish come to feed on reefs, and concluded that energy is transferred from artificial reefs to fishes through decapods, amphipods and juvenile which are concentrated on these structures. The numbers of individuals per group and biodiversity levels were maintained within certain constancy over time sustained by the replacement of some species to another.
The advantages to have the video camera located on OBSEA are: the high sampling frequency over extended temporal windows, and the avoidance of diving (which is invasive and influence fish behavior). In conclusion, long-term studies based on powerful biological data series from image analysis represent a suitable tool for observing marine species.

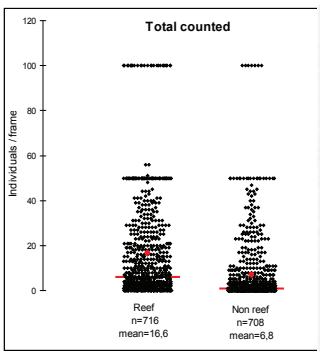

Figure 3. Number of fishes observed in frames from the artificial reef and non reef (seabed). Red circle corresponds to mean and red stripe to median values.

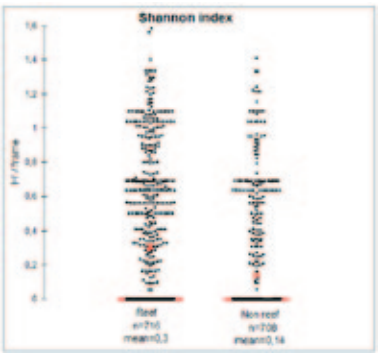

Figure 4. Values of Shannon biodiversity index for frames from the artificial reef and non reef (seab ed). Red circle corresponds to mean and red stripe to median values.